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PRINTED, EMBOSSED AND METALLIZED MATERIAL

THIS INVENTION relates to printed material. More particularly, the invention relates to a process for producing printed material suitable for, but not limited to, packaging. The invention also relates to an apparatus or installation for producing such printed material, and to a flexible printed material whenever produced in accordance with the process or by means of the apparatus or installation.

According to the invention there is provided a process for producing printed material comprising an elongated web of flexible sheet material, the process including the process steps of:

printing an embossing coating on at least a portion of a surface of a major face of a web of said sheet material;

embossing the embossing coating printed on said major face by means of an optically variable device; and

metallising at least a portion of said surface of said major face with a metal coating,

the printing and the embossing being carried out in-line and continuously until a desired length of the surface or web has been embossed, the web being advanced past a series of work stations where the in-line process steps are respectively carried out, the series including a printing station where the printing of the embossing coating takes place and an embossing station, following the printing station, where the embossing takes place, to produce a web of flexible sheet material having a major face which is at least partially embossed, at least a portion of said major face being

metallised.

In a particular embodiment of the method, the printing of the embossing coating may be on a portion of said surface of said major face, the metallising being of the entire surface of said major face and taking place after the embossing, to produce a web of flexible sheet material having a major face which is partially embossed, the whole of said major face being metallised. Naturally, instead, only part of the major face need be metallised. More particularly, the flexible sheet material may be a transparent flexible polymeric plastics film.

The process may include the further step of colour-printing said major face of the web, the colour-printing being carried out continuously and in-line with the printing of the embossing coating and in-line with the embossing. Preferably, the colour-printing is confined to at least one unembossed portion of the surface of said major face.

The colour-printing may be by means of a printing cylinder using a gravure printing technique, although any other suitable printing technique can naturally be employed instead. Preferably, the colour-printing cylinder forms part of a gravure printing press.

In particular, the colour-printing may be carried out prior to the printing of the embossing coating.

In other words, the colour-printing may be carried out prior to the metallising and optionally prior to the printing of the embossing coating, between the

station and the embossing station.

More particularly, as indicated above, the embossing step and each printing step may be carried out by separate cylinders forming part of a single gravure printing press.

The invention extends to an apparatus or installation for producing printed material, the apparatus or installation comprising a plurality of processing stations, the processing stations including:

an embossing coating printing station for printing an embossing coating on at least a portion of a surface of a major face of an elongated web of flexible sheet material;

an embossing station for embossing the embossing coating printed on the web at the printing station; and

a metallising station for metallising at least a portion of said surface of said major face,

the printing station and the embossing station being arranged in-line, and the apparatus or installation being arranged and constructed to advance an elongated web of flexible sheet material in succession past said printing station and said embossing station.

Conveniently the apparatus or installation is arranged and constructed to advance the elongated web of flexible sheet material past the embossing station and then to the metallising station, to facilitate metallising the entire surface of said major face, or part thereof.

**CLAIMS:**

1. A process for producing printed material comprising an elongated web of flexible sheet material, the process including the process steps of:

printing an embossing coating on at least a portion of a surface of a major face of a web of said sheet material;

embossing the embossing coating printed on said major face by means of an optically variable device; and

metallising at least a portion of said surface of said major face with a metal coating,

the printing and the embossing being carried out in-line and continuously until a desired length of the surface or web has been embossed, the web being advanced past a series of work stations where the in-line process steps are respectively carried out, the series including a printing station where the printing of the embossing coating takes place and an embossing station, following the printing station, where the embossing takes place, to produce a web of flexible sheet material having a major face which is at least partially embossed, at least a portion of said major face being metallised.

2. A process as claimed in Claim 1, in which the printing of the embossing coating is on a portion of said surface of said major face, the metallising being of the entire surface of said major face, to produce a web of flexible sheet material having a major face which is partially embossed, the whole of said major face being metallised.

3. A process as claimed in Claim 1 or Claim 2, in which the flexible sheet material is a transparent flexible polymeric plastics film.

4. A process as claimed in any of Claims 1 to 3 inclusive, which includes the further step of colour-printing said major face of the web, the colour-printing being carried out continuously and in-line with the printing of the embossing coating and in-line with the embossing.
5. A process as claimed in Claim 4, in which the colour-printing is confined to at least one unembossed portion of the surface of said major face.
6. A process as claimed in Claim 4 or 5, in which the colour-printing is by means of a printing cylinder using a gravure printing technique.
7. A process as claimed in Claim 6, in which the colour-printing cylinder forms part of a gravure printing press.
8. A process as claimed in any one of Claims 4 to 7 inclusive, in which the colour-printing is carried out prior to the printing of the embossing coating.
9. A process as claimed in any one of the preceding claims, in which the metallising step and any additional process steps, other than in-line printing and embossing steps, are carried out batchwise.
10. A process as claimed in any one of the preceding claims, in which the embossing by means of an optically variable device is selected from the group consisting of holographic embossing, stereographic embossing, diffraction grating embossing, dot matrix embossing and combinations thereof.

11. A process as claimed in Claim 10, in which the embossing is holographic embossing.

12. A process as claimed in any one of the preceding claims, in which the embossing is such as to provide the embossed web with an at least partially repeating embossed pattern.

13. A process as claimed in any one of the preceding claims, which includes the further process step of laminating the embossed metallised web with a backing web of flexible sheet material, to provide a laminated composite material, in which the embossing, the metal coating and any colour-printing are sandwiched between the webs so that the embossed metallised web is reverse-printed, at least one of the webs being transparent.

14. A process as claimed in any one of the preceding claims, which includes the steps of slitting the embossed metallised web lengthwise into at least two strips, and rolling said strips into rolls.

15. A process as claimed in any one of the preceding claims, in which each said web is made of a polymeric material selected from the group consisting of polyesters, polypropylenes, polyethylenes and polyvinyl chlorides, and mixtures, blends and copolymers thereof.

16. A process as claimed in Claim 15, in which the polymeric material is selected from polyesters and polypropylenes, the metallising being by vacuum metallising.

17. A process as claimed in any one of the proceeding claims, in which the metallising step is carried out by means of aluminium.

18. A process as claimed in any one of the preceding claims, in which the embossing coating is solvent-based, the embossing coating being printed by means of a printing cylinder.

19. A process as claimed in Claim 18, in which the embossing coating is provided by the printing cylinder using a gravure printing technique, the cylinder forming part of a gravure printing press.

20. A process as claimed in any one of the preceding claims, in which the embossing is by means of an embossing cylinder, carrying a holographically engraved cylindrical surface.

21. A process as claimed in Claim 20, in which the embossing cylinder forms part of a gravure printing press.

22. A process as claimed in any one of the preceding claims, in which the embossing step and each printing step are carried out by separate cylinders forming part of a single gravure printing press.

23. An apparatus or installation for producing printed material, the apparatus or installation comprising a plurality of process stations, the process stations including: an embossing coating printing station for printing an embossing coating on at

least a portion of a surface of a major face of an elongated web of flexible sheet material;

an embossing station for embossing the embossing coating printed on the web at the printing station; and

a metallising station for metallising at least a portion of said surface of said major face,

the printing station and the embossing station being arranged in-line, and the apparatus or installation being arranged and constructed to advance an elongated web of flexible sheet material in succession past said printing station and said embossing station.

24. An apparatus or installation as claimed in Claim 23, which is arranged and constructed to advance the elongated web of flexible sheet material past the embossing station and then to the metallising station.

25. An apparatus or installation as claimed in Claim 24, which includes at least one colour-printing station, arranged in-line with the embossing coating printing station and the embossing station, for colour-printing a coloured coating on an uncoated portion of the surface of said major face.

26. An apparatus or installation as claimed in any one of Claims 23 to 25 inclusive, in which each processing station, other than said printing stations and embossing station, is arranged for batchwise processing of the web.

27. An apparatus or installation as claimed in any one of Claims 23 to 26 inclusive, in which each printing station and the embossing station form part of a single gravure printing press having a plurality of cylinders, each printing station and the embossing

station being arranged in-line and each comprising one of the cylinders of the press.

28. An apparatus or installation as claimed in any one of Claims 23 to 27 inclusive, in which the metallising station comprises a vacuum-metallising station, for vacuum-metallising the major face.

29. An apparatus or installation as claimed in any one of Claims 23 to 28 inclusive, which includes a laminating station for laminating said major face of the web, after the metallising, to a backing web of flexible sheet material.

30. An apparatus or installation as claimed in any one of Claims 23 to 29 inclusive, which includes a slitting station for slitting the metallised web into portions.

31. An apparatus or installation as claimed in any one of Claims 23 to 30 inclusive, which includes a rolling station for rolling each metallised web or web portion up into at least one roll.

32. A flexible printed material comprising a web of flexible sheet material, whenever produced by the process claimed in any one of Claims 1 to 22 inclusive.

33. A flexible printed material, comprising a web of flexible sheet material, whenever produced by means of the apparatus or installation claimed in any one of Claims 23 to 31 inclusive.

34. A flexible printed material, as claimed in Claim 32 or Claim 33, in which the

web comprises an embossed portion and an unembossed portion which respectively extend continuously along the full length of the web.

35. A flexible printed material, as claimed in Claim 34, in which the embossed portion and unembossed portion are respectively divided into separate parts, the parts being spaced from one another and alternating along the length of the web.

36. A flexible printed material as claimed in Claim 34 or Claim 35, in which the portions are arranged such as to provide the web with at least one repeating pattern.

37. A flexible printed material as claimed in any one of Claims 32 to 36 inclusive, in which the web which is embossed and metallised, and any backing web used, are made from a member selected from the group of polymeric plastics materials consisting of polyesters, polypropylenes, polyethylenes, and polyvinyl chlorides, and mixtures, blends and copolymers thereof.

38. A flexible printed material as claimed in Claim 32 or Claim 33, which is in the form of at least one bank note.

39. A flexible printed material as claimed in any one of Claims 32 to 37 inclusive, which is in the form of a packaging material.

40. A process as claimed in Claim 1, substantially as described and as illustrated herein.

41. An apparatus or installation as claimed in Claim 23, substantially as described

and as illustrated herein.

42. A flexible printed material as claimed in Claim 32 or Claim 33, substantially as described and as illustrated herein.